SSVEO IFA List **Date:02/27/2003**

STS - 27, OV - 104, Atlantis (3) **Time:04:22:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-27-V-01	OI
A)MMACS-02, B)	**GMT:**		**SPR** A) 27RF08, B) None,	**UA**	**Manager:**
MMACS-01, C) EECOM-			C) None, D) None, E) None	**PR**	
01, D) None, E)			**IPR** None		**Engineer:**

Title: Operational Instrumentation Failures. (ORB)

Summary: DISCUSSION: A. The auxiliary power unit (APU) 1 exhaust gas temperature 2 measurement (V46T0140) became erratic after Main Engine Cutoff (MECO). Later, the measurement failed open. Postflight troubleshooting confirmed the transducer failure. The transducer has been removed and replaced. Failure analysis will be tracked by CAR 27RF08. This is a criticality 2R3 measurement.

B. The auxiliary power unit (APU) 1 gas generator (GG) bed temperature (V46T0122) had a high bias during prelaunch operations. The bias was approximately 45 degrees F high at GG bed temperatures of 350 degrees F. The bias was not present after APU start during the final prelaunch activities. This bias is considered acceptable. No corrective action is required. This is a criticality 3/3 measurement. C. Oxygen flow transducer measurements 1 and 2 (V61R2105A and V61R2205A) were biased high and toggling just above the specification value of 0.25 lb/hr. Calibration shows that both MSIDs have shifted +.25 (0 reads .25) at low end and -.8 (4.8 reads 4.0) at high end. GSE is suspect. If transducers have shifted, bias is acceptable until panel is removed for planned cabin pressure transducer changeout post STS-30. A waiver will be requested. Criticality 3/3. D. The auxiliary power unit (APU) 1 GG valve module T-1 temperature measurement (V46T0171A) was biased 40 to 50 degrees F higher than the T-2 temperature measurement which was 98 degrees F during entry. This bias is considered acceptable. No corrective action is required. This is a criticality 2R3 measurement. E. The modular auxiliary data system (MADS) reinforced carbon carbon (RCC) chin temperature measurement (V09T9889A) became erratic during entry. Postflight troubleshooting could not reproduce the anomaly. The temperature transducer and associated wiring check out within specification. No corrective action is required. This is a development measurement and has no flight criticality. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:17	Problem	**FIAR**	**IFA** STS-27-V-02	OI - Sensors

MMACS-03 **GMT:** 337:14:48 **SPR** 27RF02 **UA** **Manager:**

IPR **PR** EPD-0546

Engineer:

Title: Left External Tank Umbilical Door Ready-to-Latch Indicator 2 Indicated Off When It Should Have Indicated On. (ORB)

Summary: DISCUSSION: At approximately 337:14:48 G.m.t., during closure of the external tank (ET) doors, the left umbilical door ready-to-latch indicator 2 (V56X3542X) indicated off when it should have indicated on. Correct indications were received for ready-to-latch indicators 1 and 3 and the door latched normally. Testing at KSC reproduced the failure. Upon inspection, a broken connector backshell (50P897) was found at the ready-to-latch switch housing assembly. Two bare wires were exposed which shorted and blew the associated fuses.

The current requirement provides the option to replace this straight backshell with another standard single-piece backshell or a split backshell. The damaged wires were repaired and the broken backshell was replaced with an identical standard single-piece backshell. Rockwell has been directed to pursue a design change to replace all straight backshells on these connectors with 90-degree backshells. Each ET door has two aft and one forward ready-to-latch indicators and the current vehicle configuration of all three vehicles is as follows: Location Connector No. Comments Left aft 50P895 Straight backshell 50P897 Straight backshell Left forward 50P899 Straight backshell Right aft 50P896 90-degree backshell 50P898 90-degree backshell Right forward 50P9902 Straight backshell A Building 45 Request requiring inspection of the aft ready-to-latch connectors during the aft area closeout on the pad has been processed for STS-29 and STS-30; an RCN will be processed for all flights between STS-30 and the implementation of the design change. CONCLUSION: The left ET umbilical door ready-to-latch indicator 2 failed due to a broken connector backshell resulting in damaged wires which caused a subsequent short and blown fuses. The most probable sources of damage to the connector backshell are high traffic in the area of proximity to platforms. CORRECTIVE_ACTION: The broken connector backshell was removed and replaced. The damaged wires were repaired and Rockwell has been directed to change all straight backshells on these connectors on all three vehicles to 90-degree backshells. A Building 45 Request (Chit J-2931) requiring inspection of the aft ready-to-latch connectors during the aft area closeout on the pad has been processed for STS-29 and STS-30. An RCN will be processed for all flights between STS-30 and the implementation of a design change. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** 000:00:11	Problem	**FIAR**	**IFA** STS-27-V-03	MPS
BSTR-01, BSTR-03	**GMT:** 337:14:42		**SPR** 27RF03	**UA**	**Manager:**
			IPR	**PR** MPS-4-04-0449	
					Engineer:

Title: MPS LH2 Topping Valve Simultaneous Open/Closed Indications. (ORB)

Summary: DISCUSSION: At the beginning of the main propulsion system (MPS) dump after main engine cutoff at approximately 337:14:41:20 G.m.t., the MPS liquid hydrogen (LH2) topping valve was commanded from the closed to the open position. Although the valve-open indicator then correctly indicated "on", the valve-close indicator incorrectly remained "on". The valve displayed simultaneous open and closed indications throughout the duration of the MPS dump.

At 337:14:43:35 G.m.t., the MPS dump was completed and the LH2 topping valve was commanded to closed. The valve-open indicator stayed in the "on" state, continuing the simultaneous open/closed indications. Approximately 2 1/2 minutes after the MPS dump completion, the first MPS vacuum inerting was initiated and the LH2 topping valve was commanded open. Both the open and closed indicators remained "on". About eight (8) minutes later, the valve-closed indicator cycled to "off" even though no changes were made in the actual valve configuration. For the remainder of the mission, both the open and closed indicators correctly reflected the expected position. The failure of these indicators to operate during cryogenic operations indicates a thermally induced problem. The MPS pressure decay during the MPS dump and first vacuum inerting was nominal, proving that the topping valve moved to its commanded positions during these activities. CONCLUSION: The MPS LH2 topping valve functioned normally during the entire mission. The simultaneous open and closed indications of the valve were most probably the result of a lack of the position-indicator microswitches to function properly under cryogenic conditions. CORRECTIVE_ACTION: The MPS LH2 topping valve was removed and returned to the vendor. Failure analysis is being tracked by CAR 27RF03. EFFECTS_ON_SUBSEQUENT_MISSIONS:

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:07:04	Problem	**FIAR**	**IFA** STS-27-V-04	APU
MMACS-05	**GMT:** 337:21:35		**SPR** 27RF07	**UA**	**Manager:**
			IPR 30RV0030	**PR**	
					Engineer:

Title: APU 2 Gas Generator Heater System Malfunction. (ORB)

Summary: DISCUSSION: At 337:20:45 G.m.t., the auxiliary power unit (APU) 2 gas generator/fuel pump A system heaters were selected by panel switch. The A heaters did not respond, so at 338:02:37 G.m.t., the B system heaters were selected to verify B heater operation. When the APU 2 gas generator/fuel pump temperatures immediately began increasing, the A heaters were once again selected at 338:02:46 G.m.t., with negative results. At 338:08:12 G.m.t., the B heaters were selected for the remainder of the mission.

Because of the satisfactory operation of the APU 2 gas generator/fuel pump B system heaters, the usage of APU 2 was nominal throughout the mission. The A and B heater systems on APU's 1 and 3 performed nominally during the mission. Post-mission analysis indicated the problem to be the three-position, four-pole APU 2 Heater Gas Gen/Fuel Pump switch on panel A12. An anomaly was verified that intermittently prevented one or two contacts from engaging when the switch was placed in the A

AUTO position. A false-detent condition existed from a build-up of tolerances within the contact mechanisms. This condition prevented the contact roller from seating properly in the engaged position when the switch was moved too gently. Switch movement by snap action was required to ensure proper contact engagement. No contamination or oxidation was present within the contact assembly. The B AUTO position of the switch functioned properly. CONCLUSION: The APU 2 gas generator/fuel pump A system heaters did not function during the entire mission because one or two contacts in the heater switch on panel A12 did not engage as a result of an unfavorable build-up of tolerances within the switch contact mechanism. This condition was not a switch failure. Because of the intermittent nature of this anomaly, the problem was not revealed in preflight vehicle testing. CORRECTIVE_ACTION: The APU 2 Heater Gas Gen/Fuel Pump switch on panel A12 was removed and replaced. Analysis of the switch revealed that this same anomaly could occur in similar switches. However, if such a condition should occur on a future mission, it can be rectified by cycling the switch and ensuring that it is properly in detent. No action is required affecting the current switch design. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:23:13	Problem	**FIAR**	**IFA** STS-27-V-05	Atmospheric
EECOM-02	**GMT:** 338:13:44		**SPR** 27RF01	**UA**	Revitalization Subsytem
			IPR None	**PR**	**Manager:**
					Engineer:

Title: Humidity Separator B Flooded. (ORB)

Summary: DISCUSSION: Shortly after wakeup on the second flight day (338:13:44 G.m.t.) the crew reported that about two gallons of free water was discovered in and around the ECLSS bay. Water appeared to be coming from humidity separator B. Waste water quantity showed a corresponding two-gallon deficit compared to predictions.

The crew performed in-flight maintenance to clean up the free water and switched to humidity separator A which performed normally for the remainder of the mission. Both the OV-104 and OV-103 (STS-26) humidity separators were removed and sent to the vendor for testing. The OV-104 humidity separator B was found to be non-functional due to a clogged pitot tube which prevented liquid water from being pumped out of the unit. OV-104 humidity separator A functioned within specification. OV-103 humidity separator B functioned within specification. The OV-103 humidity separator A was degraded (6 percent water carryover vs. 1 percent specified). Check valve leaks are also suspected in OV-103 humidity separator A and may be contributing to its degradation. Disassembly of this unit to determine actual component failure is in process at the vendor. CONCLUSION: OV-104 humidity separator B failed due to a clogged pitot tube. OV-103 humidity separator A was degraded. Failure analysis is in process. CORRECTIVE_ACTION: Spare humidity separators were placed on board OV-103 for subsequent flights. Their humidity removal capability was successfully verified under OMRSD paragraph V61ANO.020. Identical work is in progress for OV-104. The humidity separators flown on STS-27 and STS-26 will be repaired and used as spares. A detailed failure analysis will be performed at the vendor and results for both the STS-26 and STS-27 humidity separators will be tracked on CAR 27RF01. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR FSC-EE-0646	IFA STS-27-V-06	TAGS
INCO-02, INCO-03	GMT: 338:11:25		SPR	UA	Manager:
			IPR None	PR	
					Engineer:

Title: Uplink Text and Graphics System hardcopier Paper Jam.Spontaneous TAGS hardcopier status change. (GFE)

Summary: DISCUSSION: At about 338:11:25 G.m.t., while receiving and processing Text and Graphics System (TAGS) Mode 1 images, the TAGS hardcopier experienced a paper jam. Thirty-seven pages of processed TAGS images were in the paper tray at the time of the jam. A total of 46 pages had been processed through the hardcopier during the mission prior to the jam. Attempts by the crew to clear the jam using the TAGS in-flight maintenance tool were unsuccessful. The TAGS hardcopier was powered off and the Teleprinter was utilized for all subsequent uplink message traffic during the mission. There was no adverse effect on the mission.

Postflight descriptions by the crew of the jam indicated that processed pages were not stacking properly in the hardcopier paper tray. This would ultimately have blocked the exit slot of the developer unit and caused the pages being developed to jam inside the developer. Postflight inspection of the hardcopier prior to its removal, verified that paper was jammed in the developer unit. The failed TAGS hardcopier was removed and replaced, and has undergone failure analysis by JSC personnel to determine why the paper was not stacking properly in the paper tray. Postflight inspection of the disassembled hardcopier developer assembly and of TAGS messages removed from the hardcopier by the crew revealed contamination from a black charred substance. The source of the contamination was a blue chalky substance found on the face of the unprocessed paper roll prior to flight. No other possible sources have been identified. The presence of the blue chalky substance was not believed to be significant at the time and no action was taken. A preflight sample of the contaminated paper was inadvertently discarded. A postflight examination of the remaining unused paper revealed no contamination. The vendor of the paper has no knowledge of any such blue chalk being used in any phase of paper production. This is the only instance in which any type of contamination has been observed on paper procured from this vendor and appears to be an isolated incident. There were no problems of any type with this hardcopier unit during extensive preflight testing using paper known to be free of contamination. Similar types of paper jams have been induced in engineering units by using old paper with a high moisture content because of long term exposure to humidity in the atmosphere. In these tests, it has been noted that pages tend to stick to one another due to the presence of moisture and that pages tend to curl because of paper memory from heating the cylindrical developer drum. It has been further noted that these tendencies get worse as paper moisture content increases. Although the moisture content of the paper undoubtedly contributed to the paper jam, that alone was probably not sufficient to cause it. At about 338:01:52 G.m.t., while configured in the READY state, the TAGS hardcopier spontaneously changed its status to STANDBY as a new message transmission began. The hardcopier was immediately reconfigured to READY and uplink message transmission continued. There was no mission impact and the anomaly did not recur during the flight. Postflight failure analysis has yielded no explanation for the anomaly, although it has been duplicated on rare occasions in engineering models. CONCLUSION: The TAGS hardcopier paper jam was caused by improper automatic stacking of processed pages in the hardcopier paper tray. The most likely cause of the improper stacking was a combination of the presence of small amounts of water given off by the paper during the heat development process and the chalky contamination present on the paper, that when heated together in the developer created a sticky substance that caused the pages to

adhere to one another. The cause of the spontaneous hardcopier status change is unknown. CORRECTIVE_ACTION: The TAGS hardcopier, Part No. AV14453, Serial No. 004, was removed, replaced, and is undergoing failure analysis. The results of this activity will be tracked via FIAR JSC-EE-0646. For future missions, all TAGS paper rolls will be inspected for contamination prior to shipment to KSC for flight usage. Any recurrence of the hardcopier status change anomaly on any future flight will have no mission impact as the hardcopier will simply be reconfigured and operations continued. The Teleprinter will continue to be flown as a backup until the TAGS units have demonstrated acceptable reliability. EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending results of the failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-27-V-07	TPS
None	**GMT:** Postlanding		**SPR** A) 27RF13, B) 27RF09, C) 27RF12	**UA** **PR**	**Manager:**
			IPR None		**Engineer:**

Title: Thermal Protection System Damage a. Tile Damage. b. Right Orbital Maneuvering System TPS Carrier Panel Missing. c. Potential Overtemperature Effects on the TACAN 2 Lower L-band Antenna. (ORB)

Summary: DISCUSSION: a. Postlanding inspection of OV-104 (Atlantis) on the runway at the Dryden Flight Research Facility revealed substantial thermal protection system (TPS) tile damage on the lower right fuselage and wing. Damage sites on the right side were more numerous than observed on previous flights, and there was almost no damage present on the left side. These unusual conditions led to the formation of the Orbiter TPS Damage Review Team by the Director of the National Space Transportation System (NSTS). The primary responsibility of the team was to determine the cause(s) of the TPS damage to OV-104 on STS-27.

The OV-104 TPS damage was measured, mapped, and recorded. The damage severity and the contrast in right-side versus left-side damage was readily discernible. The inspection results and damage distribution were as follows: 1. Total recorded damage sites were 707, with 644 occurring on the lower surface. 2. Total recorded damage sites with any dimension greater than 1 inch were 298, with 272 occurring on the lower surface. 3. The left side had only two damage sites with any dimension greater than 1 inch. 4. The eleven lower surfaces were undamaged. 5. The right OMS pod had 14 damage sites with any dimension greater than 1 inch. 6. The right rudder speed brake had four damage sites with any dimension greater than 1 inch. The inspection also revealed that one complete tile was missing from the forward right fuselage over the L-band antenna cover. A foreign object, later identified as Marshall Sprayable Ablator (MSA)-1 material, was found embedded in a right orbital maneuvering system (OMS) pod advanced felt reusable surface insulation (AFRSI) blanket near the right OMS pod TPS carrier panel that became dislodged. The Orbiter TPS Damage Review Team has completed the assigned task responsibilities and has reported that the STS-29 external tank and solid rocket boosters are ready to launch. The team's findings and recommendations are documented in the "STS-27R OV-104 Orbiter TPS Damage Review Team Summary Report", Volume I of IX that has been accepted by the Shuttle Program. b. After launch, the right-hand OMS pod carrier panel assembly (V070-396403-00-2, S/N BCA 846) that installs over the door came off. During the postflight inspection of the area, the panel screws were still in place indicating that no washers had been installed on the carrier panel screws. An inspection of the left panel (same design) reflected that the correct hardware was used. Therefore, the conclusion is that the missing carrier panel was lost because it was incorrectly installed. The loss of the panel may have resulted in minor damage to one flexible insulation blanket aft of the panel location, but the loss did not contribute to any other TPS damage. c. A tile

was missing from a damage site on the right-hand side slightly forward of the L-band antenna. Substrate heating in this area and underneath an adjacent tile was apparent. Adjacent tiles on both sides showed damage from a common source. Postflight evaluation noted a possible overtemperature condition for the TACAN 2 lower L-band antenna. An inspection detected damage to the access panel which made the panel no longer usable, but no similar damage was detected on the antenna. Thermal reconstructions by analyses were consistent with the postflight condition of the tile cavity and surrounding structure. An assessment to provide the failure scenario and technical rationale for the missing tile was performed by the Orbiter TPS Damage Review Team; this evaluation is reported in detail in the STS-27R OV-104 Orbiter TPS Damage Review Team Report, Volume IV, Action Item 37 and Appendix J. In summary, a conclusion was reached that the failure resulted from ascent debris impact which initially caused partial tile loss. Subsequent entry heating led to overheating of the remaining tile bondline and complete loss of the tile prior to the postlanding inspection. CONCLUSION: a. The most severe STS-27R Orbiter tile damage resulted from dislodged ablative insulating material from the right-hand SRB nose cone which impacted the Orbiter approximately 85 seconds into the flight. Other TPS damage was probably caused by impacts from dislodged external tank insulation as has been experienced on many previous flights. b. The carrier panel became dislodged because of an incorrect installation. The loss of the panel may have resulted in minor damage to one flexible insulation blanket aft of the panel location, but the loss did not contribute to any other TPS damage. c. The damage resulted from ascent debris impact which initially caused partial tile loss. Subsequent entry heating led to overheating of the remaining tile bondline and complete loss of the tile prior to the postlanding inspection. CORRECTIVE_ACTION: a. Remove and replace tiles. b. Replace panel and verify proper hardware configuration on all vehicles. c. Remove and replace the L-band access panel; inspect the antenna for thermal damage. (Ref CAR 27RF-12-010) EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:23:56	Problem	**FIAR**	**IFA** STS-27-V-08	OMS/RCS
PROP-01	**GMT:** 339:14:27		**SPR** 27RF10	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Aft Reaction Control System Right Oxidizer Helium "B" Regulator Regulating at Low Pressure. (ORB)

Summary: DISCUSSION: After switching from the helium "A" regulators to the "B" regulators, the aft right Reaction Control System (RCS) oxidizer tank pressure decreased from 249 to 242 psi. During a later burn, the pressure dropped to 236 psi and slowly recovered to 240 psi. When switched back to the "A" regulators, the RCS oxidizer tank pressure rose to a nominal 249 psi.

A helium blowdown test was performed on the "B" regulators by KSC which confirmed the low pressure regulation. The aft right oxidizer regulator has been removed and sent to vendor for failure analysis. CONCLUSION: The aft right RCS oxidizer tank pressure decrease was caused by a failed helium "B" regulator. The cause of the failed regulator is undetermined, pending failure analysis. CORRECTIVE_ACTION: The regulator has been removed and replaced and the vendor is conducting a failure analysis. EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:23:59	Problem	**FIAR**	**IFA** STS-27-V-09	Active Thermal Control
EECOM-03	**GMT:** 339:14:30		**SPR** None	**UA**	Subsytem
			IPR None	**PR**	**Manager:**
					Engineer:

Title: Cabin Temperature Controller 2 Non-Responsive. (ORB)

Summary: DISCUSSION: At approximately 339:14:30 G.m.t., the crew reported that the motor for cabin temperature controller 2 was frozen and would not move when the cabin temperature controller switch position was changed from controller 1 to controller 2. During the 4 to 5 minutes that controller 2 was selected, its actuator did not move from its original position and the crew reported that the actuator felt mechanically bound up. The crew then switched back to the original cabin temperature controller 1 which performed normally for the remainder of the mission.

The cabin temperature controller 2 was retested at KSC and performed nominally. CONCLUSION: Cabin temperature controller 2 did not appear to respond because it was not activated for a sufficient period of time to reach a thermal steady-state and allow the motor drive to transit the actuator to its normal operating position. CORRECTIVE_ACTION: A crew procedure change is planned to alert the crew to the time required for the temperature controller to reach its normal operating position. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 1	**MET:** 003:13:18	Problem	**FIAR**	**IFA** STS-27-V-10	C&T - Ku-band
MMACS	**GMT:** 341:03:49		**SPR**	**UA**	**Manager:**
			IPR 30RV-0034	**PR**	
					Engineer:

Title: Ku Band Boom Stow Indicator #2 Malfunction (ORB)

Summary: Data review isolated the problem to ground data processing. Problem was transferred to MOD. STSOC DR 091909.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-27-V-11	OMS/RCS

PROP-02 **GMT:** **SPR** None **UA** **Manager:**

IPR None **PR**

Engineer:

Title: Orbital Maneuvering System Left Gaseous Nitrogen Isolation Valve Coil Failure (ORB)

Summary: DISCUSSION: The left Orbital Maneuvering System (OMS) Gaseous Nitrogen (GN2) tank showed a pressure rise from coil heat of about one-half of the rise normally seen.

Troubleshooting at KSC revealed no anomalies in the valve or power to the valve. Research into valve history showed that the GN2 pressure rise seen on this engine was consistent with pressure rises seen on three previous flights. Also, three other engines were found to have similar pressure rises. These pressure rise differences are believed to be a function of differences in heat transfer paths within the GN2 isolation valves rather than an indication of a valve or power failure. Verification of the redundant coils in the GN2 isolation valve is a standard part of KSC preflight checkout. CONCLUSION: No functional discrepancies have been found. The discrepancy is considered to result from the variability of individual GN2 isolation valves and engines rather than an indication of a valve or Orbiter power problem. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:00:45	Problem	**FIAR**	**IFA** STS-27-V-12	FC/PRSD
EECOM-04	**GMT:** 339:15:16		**SPR** 27RF14	**UA**	**Manager:**
			IPR 30RV-0032	**PR**	
					Engineer:

Title: Fuel Cell 2 Alternative Water Line Erratic Temperature (ORB)

Summary: DISCUSSION: The fuel cell 2 alternate water line temperature cycled erratically between 100 and 125 deg. F after the line heaters were switched from the A circuit to the B circuit at approximately 339:15:16 G.m.t. The normal control range is 70 to 90 deg. F. The erratic behavior ceased when the line heaters were switched back to the A circuit.

Potential causes of the problem were isolated to either an erratic thermostat B or a small leak in the alternate water line check valve which allowed a trickle flow of hot water through the line. During troubleshooting at KSC, the thermostat B controlled within specification and the alternate water line check valve was tested and exhibited no leakage. A transient problem with the B thermostat is the most likely cause of this anomaly because the check valve exhibited no physical leakage and the problem appeared to correspond to activation of the B heaters. The B thermostat has been removed and replaced. The suspect thermostat will be sent to the vendor for detailed analysis. CONCLUSION: The problem was most likely caused by transient erratic behavior of the fuel cell 2 alternate line heater B thermostat.

CORRECTIVE_ACTION: The thermostat has been removed and will be sent to the vendor for analysis. Results will be tracked via CAR 27RF14.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:10	Problem	**FIAR**	**IFA** STS-27-V-13	MPS
BSTR-01	**GMT:** 337:14:41		**SPR** 27RF17	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: LH2 Manifold Pressure Low During Post-MECO Dump (ORB)

Summary: DISCUSSION: At 337:14:41:12 G.m.t., after initiation of the main propulsion system (MPS) liquid hydrogen (LH2) dump, the LH2-17 inch feedline manifold pressure began decreasing from approximately 51 psia. When this pressure reach 20 psia approximately 20 seconds later, the LH2 manifold repressurization system should have began flowing regulated helium at approximately 20 psia into the manifold. However, the manifold pressure continued to drop, reaching a value of 17 psia about 57 seconds after dump initiation. At this time, the manifold pressure suddenly increased and remained at 21 psia until commanded off.

The LH2 manifold repressurization system includes two 2-way solenoid valves (LV42,43) which provide series isolation of the MPS pneumatic regulated helium supply from the 20-psi regulator. The valves are commanded open by the general purpose computers at the start of the MPS dump. Helium flow into the manifold is subsequently controlled by the 20-psi regulator (PR6), which is referenced to the manifold through an external sense line. Helium flow initiation is confirmed by the simultaneous increase in the pneumatic helium supply pressure decay rate and the GH2 pressurization system pressure. Data review established the initiation of the helium flow into the manifold was delayed for 57 seconds. Once the manifold repressurization helium began flowing, the system operated nominally for the remainder of the mission, providing helium for the duration of the post-MECO dump and during entry. The failure had no impact on the mission. The LH2 Manifold Repressurization system is considered non-mandatory for nominal missions. During transatlantic abort landing entries, this failure may cause a hazardous condition in the LH2 propellant system. A post-flight test was performed which pressurized the LH2 manifold to 35 psia, then allowed the pressure to slowly bleed down. The regulator exhibited the same delayed response as seen during the STS-29 propellant dump. CONCLUSION: Initiation of the 20-psia helium flow into the manifold was delayed during the MPS dump because of a sluggish regulator in the manifold repressurization system. CORRECTIVE_ACTION: Post-flight troubleshooting of the MPS LH2 manifold repressurization system at KSC revealed a malfunctioning regulator. Removal and replacement of the regulator was performed. Failure analysis of the regulator will be performed.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-27-V-14	HYD
MMACS-07	**GMT:** Prelaunch		**SPR** 27RF06	**UA**	**Manager:**

IPR **PR**

Engineer:

Title: Hydraulic System 2 Bootstrap Accumulator Pressure Lag (ORB)

Summary: DISCUSSION: When hydraulic system 2 main pump pressure switch was put to the "Normal" position during prelaunch operations at 337:14:24:48 G.m.t., the bootstrap accumulator pressure lagged the main pump pressure by approximately 15 seconds. The bootstrap pressure then instantaneously rose to equal the main pump pressure. No lag should have occurred in the equalization of these pressures. Similarly, when the hydraulic system 2 main pump pressure was brought to "Normal" for entry at 341:22:52:49 G.m.t., the bootstrap accumulator pressure lagged the main pump pressure by approximately 5 minutes 25 seconds before rapidly equalizing with the main pump pressure. In both instances, when the bootstrap accumulator pressure was equal to the main pump pressure, bootstrap accumulator pressure performance remained nominal for the remainder of the auxiliary power unit operation.

Flight data indicated that the hydraulic system 2 accumulator pressure and reservoir pressure tracked each other in both instances during the period before and after the lagging occurred, which implies that a check valve internal to the priority valve was sluggish to open. The occurrence of this problem had no impact on the mission. CONCLUSION: The delay in hydraulic system 2 accumulator pressure matching the associated main pump pressure was most probably the result of a restriction in the movement of the check valve internal to the priority valve. CORRECTIVE_ACTION: The hydraulic system 2 priority valve was removed and replaced. A failure analysis will be performed to determine the cause of the problem and will be tracked by CAR 27RF06. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:00:49	Problem	**FIAR**	**IFA** STS-27-V-15	C&T - Ku-band
INCO-05	**GMT:** 340:15:20		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	

Engineer:

Title: KU-Band Channel 2 Operations Recorder Dumps Were Initially Unsuccessful. (ORB)

Summary: DISCUSSION: At approximately 340:15:20 G.m.t., with the Ku-Band in the communications mode, the Operations (OPS) recorder dump data could not be recovered on the ground even though the telemetry seemed to indicate that the system was properly configured with channel 2 selected to OPS Recorder and channel 3 to "Off". Once a channel 3 high data select rate (HDR) select function was uplinked, the data on channel 2 were recoverable. None of the data were lost.

Postflight evaluation showed that the problem was caused by an operational return-link mode configuration error rather than a Ku-Band hardware problem. The vehicle was configured for downlink of phase modulated (PM) data while the ground station was configured to received frequency modulated (FM) data. The return-link modes for data (mode 1 for PM and mode 2 for FM) are based on the position of the HDR select switch (S15) on panel A1 and/or ground commands uplinked via the ground control

interface logic (GCIL). In both cases, the system determines the return-link mode selected by scanning the GCIL command-driver output signals via the signal processor assembly. The Ku-Band system, when initially powered in the communications mode, activates in the PM COMM mode and checks the HDR select switch functions by scanning the outputs of the GCIL command drivers to determine the return-link mode in which the system should be operating. If the system sees either "OFF", "PL INTGR", "PL ANLG", "PL DIGITAL", or "TV", the system will operate in the FM mode; otherwise it will remain in the PM mode. When the crew initiates the Ku-Band in the radar mode for self-test operations, the GCIL command driver outputs are reduced to zero voltage. At the end of self-test, the crew changes the control switch from "Panel" (crew control) to "command" (ground control) without switching the system from the radar to the communications mode and the GCIL driver outputs remain at zero volts. For data dumps, the ground normally commands the "COMM PWR ON" and verifies the configuration of channels 2 and 3 via telemetry. For a typical operation, channel 2 would be configured to "OPS Recorder" and channel 3 configured to "TV". In this case, after the self-test procedure, both the channel 2 and channel 3 data select switches onboard the Orbiter were in the "OFF" position. The flight controllers expected to see both channels in the "OFF" position and in fact the ground display indicated that both were "OFF". At this point, the ground sent a command to configure channel 2 to "OPS Recorder" and left channel 3 "OFF". The ground indication is not, however, a downlinked discrete, but rather a ground computation derived from telemetry of the GCIL command driver outputs, which displays "OFF" in the absence of other mode signals. Since the GCIL command driver outputs for the HDR select functions had been reduced to a zero voltage (including "OFF") while the system was in the radar self-test mode, no driver was active when the system was powered in the communications mode. The telemetry processed by the ground computation showed no active driver and displayed "OFF". Thus the system had been commanded on with no valid return-link function being selected and remained in the PM mode. Hence, the vehicle was downlinking PM data to a ground station that was configured to receive FM data. Once the channel 3 HDR data select function was provided via uplink command, the vehicle was configured to the desired FM return-link mode, and the data dumps were normal. The Ku-Band system hardware performed as designed. CONCLUSION: Configuration misunderstanding resulted in operational recorder dumps being unsuccessful. Hardware performed as designed. CORRECTIVE_ACTION: A constraint will be added to the Shuttle Operational Data Book to state that when the Ku-band communications system is commanded on via an uplink command, a valid channel 3 selection must be made. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:01:28	Problem	**FIAR**	**IFA** STS-27-V-16	MECH
MMACS-04	**GMT:** 337:15:59		**SPR** 27RF04	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Payload Bay Door Ready-To-Latch Indicator Hung Up. (ORB)

Summary: DISCUSSION: During opening of the starboard payload bay door at approximately 337:15:59 G.m.t., the starboard forward ready-to-latch indicator B (V37X3436Y) remained on while indicators A and C went off as designed. Within a few minutes, the B indicator also went off. No further problems were experienced with the indicator for the remainder of the mission.

Testing at KSC could not reproduce the failure. The suspected cause of switches sticking is the freeplay of the lever arm permitted by the old rigging procedure used prior to the STS-61D flow. The new procedure specifies 1/2 degree as the desired amount of freeplay; this switch was found to have 8 degrees. All of the switches in the module's subassembly have been removed and replaced with Particle Impact Noise Detection (PIND) test switches, the module has been re-rigged according to the new procedure, the new acceptance test procedure was performed, and the set screw were potted in place. The removed switches are undergoing additional testing at the contractor to obtain additional engineering data on these switches. Rationale to fly with the present switches in place: Each of the modules on the payload bay doors has four indicators (Haydon switches, some soldered and some welded), three for ready-to-latch and one for the door-closed indication. The three ready-to-latch indications are used by the automated software. One of these can be lost and the software will still vote properly. Loss of a second indication requires that a manual workaround be performed. A hand-held theodolite is used to determine if the payload door is in the correct position to perform the workaround, then a manual keyboard entry is made to complete the function. Current status of modules on all vehicles: OV-102 - None of the payload bay door modules have been re-rigged to the new specification. OV-103 - One module was re-rigged due to the anomaly experienced on STS-26. NOTE: The switch that failed on STS-26 was not rigged per the new specification, but the failure was attributed to a nylon particle found in the switch. OV-104 - Three modules have been re-rigged per the new specification and one has not. CONCLUSION: Failure could not be reproduced on the ground, but may have been due to out-of-specification freeplay resulting from utilization of the old rigging procedure. CORRECTIVE_ACTION: The module was removed from the vehicle and sent to the contractor for testing to obtain additional engineering data on these switches. All switches in the subassembly were replaced with PIND-test switches. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-27-V-17	C&T - Navaids
GNC-01	**GMT:** Prelaunch		**SPR** None	**UA**	**Manager:**
			IPR 30RV-0031	**PR**	
					Engineer:

Title: TACAN 1 Failed To Acquire KSC On Initial Activation. (ORB)

Summary: DISCUSSION: During prelaunch navigation aids activation at 9:34 G.m.t., TACAN 1 (serial number 15068) was initially powered up (MODE switch to T/R) with channel thumbwheels set to 90X for the blanking test. Approximately 2 minutes later, the channel thumbwheels were set to 59Y to acquire the KSC ground station. Automatic gain control (AGC) remained at 5.09 Vdc (indicating no signal at the receiver), and range and bearing remained in the search mode. After approximately 6 minutes, the MODE switch was cycled to OFF then back to T/R, at which time AGC went to approximately 3 Vdc (indicating signal at the receiver), and range and bearing locked on at 3.95 nmi. and 268 degrees, respectively.

These operational conditions were not a violation of Launch Commit Criteria (2 of 3 TACAN's required), and no further TACAN 1 anomalies were observed for the remainder of the flight. Data analysis indicate all MODE switch and thumbwheel contacts were good. Postflight troubleshooting failed to reproduce the anomaly. Two related problems have previously occurred on other TACAN units. The first occurred on serial number 65 during STS-4 prelaunch operations on June 27, 1982. The second occurred on serial number 63 on June 2, 1986, prior to STS-26. Numerous attempts to repeat these problems were unsuccessful. These three problems are similar

in that each involved the inability to acquire a ground station, and each was cleared by either resetting the TACAN or re-issuing a channel select command. A possible common link is that the TACAN channel select became latched up in a mode such that an improper or invalid channel was selected. The possibility of recurrence of such a latch-up is considered extremely rare, and can easily be cleared by a simple procedure. CONCLUSION: The cause of this anomaly on TACAN serial number 15068 is unknown. It most probably resulted from a failure of the TACAN to correctly recognize channel commands on initial selection. CORRECTIVE_ACTION: None, pending recurrence of a hard failure. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-27-V-18A	STR
None	**GMT:**		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Crew Could Not Re-engage 4 or 5 Volume H Door Fasteners (ORB)

Summary: DISCUSSION: Following the humidity separator anomaly (reference problem STS-27-05), the crew opened the volume H door in order to clean up free water. After door closure, four or five of the door fasteners could not be re-engaged. The remainder of the fasteners were successfully re-engaged.

After the flight, the volume H door was removed and the fasteners and receptacles were inspected. No anomalies in the fasteners or receptacles were noted. Following the inspection, the volume H door was re-closed and all of the fasteners successfully re-engaged. If the problem is repeated during a future flight and is severe enough to prevent the crew from closing the volume H door using normal procedures, the crew is provided sufficient in-flight maintenance equipment to force closure or otherwise secure the door. CONCLUSION: Normal crew module structural deformation on-orbit because of the cabin-to-space pressure differential, coupled with stress relief from removing the volume H and volume F access panels, prevented re-engagement of all of the volume H door fasteners in-flight. CORRECTIVE_ACTION: None, fly as is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-27-V-18B	STR
None	**GMT:**		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Wet Trash Door and Access Hatch Closing (ORB)

Summary: DISCUSSION: After performing the free water cleanup in-flight maintenance procedures (reference problem STS-27-05), the crew reported that the volume F wet trash access panel required more effort than normal to close and that the volume F wet trash door latch would not engage unless the latch was pre-compressed during

closure.

The wet trash panel and door latch were retested at KSC and the problems could not be duplicated. CONCLUSION: The most likely cause was normal crew module structural deformation on-orbit, because of the pressure differential, coupled with stress relief from removing the volume F and volume H access panels. If the problem recurs during a future flight and is severe enough to prevent the crew from closing the wet trash door or access panel using normal procedures, the crew is provided sufficient in-flight maintenance equipment and procedures to force closure or otherwise secure these openings. CORRECTIVE_ACTION: None. Fly as is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-27-V-18C	CREW
None	GMT:		SPR	UA	Manager:
			IPR	PR Ham Std PR 9-WCS-5005	Engineer:

Title: Footrest on Waste Collection System Difficult to Deploy and Stow (ORB)

Summary: DISCUSSION: During the postflight debriefing, the crew reported that the waste collection system (WCS) footrest required a great deal of effort to deploy and stow. The WCS was removed from the Orbiter and shipped to the vendor for servicing. Testing at the vendor verified the difficulty deploying and stowing the footrest. The difficulty was traced to a pin in the deploy/stow linkage which had been bent, most likely during installation. The bent pin was removed and replaced, restoring ease of motion to the deploy/stow mechanism.

CONCLUSION: The WCS footrest was difficult to deploy and stow due to a bent pin in the deploy/stow linkage. CORRECTIVE_ACTION: The bent pin has been removed and replaced by the vendor. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR BFC-022-F001	IFA STS-27-V-18D	PGSC
None	GMT:		SPR None	UA	Manager:
			IPR	PR	Engineer:

Title: Shuttle Portable Onboard Computer Stopped Working (GFE)

Summary: DISCUSSION: One of the two Shuttle Portable Onboard Computer (SPOC) units onboard went to "Halt" and displayed the "Bad Pointer" fault message while executing the Center of Gravity (C.G.) Manager software on flight day 4. The crew followed standard procedures to reboot the SPOC and the SPOC functioned normally during the remainder of the mission.

The "Bad Pointer" message indicated that a nonexistent memory address was requested. The nonexistent address could have been called due to a software error or hardware problem. Neither the specific SPOC unit which experienced the problem, nor the keystroke sequence leading up to the problem were documented, hence the problem has not been duplicated in postflight testing. CONCLUSION: The problem is an unexplained anomaly. Since the problem was transient and recoverable, the SPOC will be flown as is. CORRECTIVE_ACTION: None. Fly as is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR** BFCE-023-F001,	**IFA** STS-27-V-18E	Galley
None	**GMT:**		BFCE-023-F002	**UA**	**Manager:**
			SPR	**PR**	
			IPR		**Engineer:**

Title: Galley Water Dispenser and Package-In-Place Lever (GFE)

Summary: DISCUSSION: The crew reported that the galley dispensed approximately 25 percent more water than the amount selected. A similar report was received from the STS-26 crew.

In addition, the "package-in-place" microswitch failed to disengage approximately 30 percent of the times that a package was removed. Testing of the package-in-place lever after the flight failed to reproduce the microswitch problem. This problem was not experienced by the STS-26 crew. CONCLUSION: The problem of dispensing more water than the amount selected is a known generic problem in which the actual Orbiter supply water pressure is higher than the pressure level to which the water dispenser was calibrated. The package-in-place microswitch is an unexplained anomaly. CORRECTIVE_ACTION: For the near term, fly as-is. A detailed test objective (DTO) is planned for STS-30 (next OV-104 flight) to determine how much extra water is dispensed. The OV-102 galley has been recalibrated to flow less water. If the package-in-place microswitch problem is repeated, the problem can be resolved by removing and re-inserting the package or by manually manipulating the microswitch. Analysis of the dispenser problem is being tracked under FIAR BFCE-023-F001. Analysis of the package-in-place switch is being tracked under FIAR BFCE-023-F002. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR** JSC-EE-0647	**IFA** STS-27-V-19	CREW
None	**GMT:** Prelaunch		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Mission Specialist 2 Sensed Tingle in Left Ear of Headset (GFE)

Summary: DISCUSSION: During seat egress following the STS-27 scrub, Mission Specialist 2 (MS-2) received a tingle in the left ear while touching the headset interface unit (HIU) when other crew members were talking. This problem was repeated in the laboratory after the mission. The earphone low signal was internally shorted to the metal faceplate of the earphone transducer and when the ear was in contact with the faceplate and the MS-2 touched the HIU, the circuit was completed to ground. When other crew members spoke, a voltage was present on the earphone low line which caused the problem. At a thumbwheel setting of 5, the voltage present is 16 Vrms. At the maximum volume control setting, the voltage present is 30 Vrms.

At 30 Vrms the circuit current is only 1-2 ma. While these levels of voltage and current can be felt, there is no electrical hazard for the crew. A failure analysis of the transducer is being performed. This is an isolated event as none of the 100 other transducers tested were shorted. CONCLUSION: An interal short within the earphone transducer caused the slight tingling sensed by the MS-2 in the left ear. CORRECTIVE_ACTION: The transducer will be removed, replaced, and subjected to failure analysis. The results of this activity will be tracked by FIAR JSC EE647. A continuity test for detecting shorts will be performed on each unit prior to flight. EFFECTS_ON_SUBSEQUENT_MISSIONS: None pending the results of failure analysis

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR** B-FCE-029-F003	**IFA** STS-27-V-20A	CCTV
None	**GMT:**		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Closed Circuit Television Monitor 1 Failed to Display Video Inputs (GFE)

Summary: DISCUSSION: Closed circuit television (CCTV) monitor 1 would not display video from any signal source. The crew followed malfunction procedures and cycled power to monitor 1, and the monitor then worked properly for the remainder of the mission.

The monitor fault light came on while setting up for the secure CCTV detailed test objective. There was no video signal input to the monitor, but power was applied. Under these conditions, it is normal for the fault light to come on. This condition was repeated during postflight testing. Note that cycling monitor power does not reset the

video input. Previous investigations have shown that maximum current will be drawn by the low and high voltage power supplies when no signal or synchronization is applied. This maximum current is near the threshold of where the overcurrent sensor is set to light the fault light. The fault light will turn on in about half of the monitors when this condition is present. CONCLUSION: Ground testing showed no anomalies associated with the monitor. The most probable cause of the fault light being on was that no video signal had been selected before the monitor was powered on the first time, and this is normal operation. The most probable cause of the fault light not coming back on when the monitor was powered up again after the malfunction procedure had been followed is that a video signal was selected during the malfunction procedure. CORRECTIVE_ACTION: The Flight Training Division has been notified of the procedures to be used to prevent recurrence of this behavior. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR B-FCE-029-F005,	IFA STS-27-V-20B	CCTV
INCO-06	GMT:		B-FCE-029-F007	UA	Manager:
			SPR	PR	
			IPR		Engineer:

Title: Closed Circuit Television Camera A Unable to Focus (GFE)

Summary: DISCUSSION: The crew reported a thumping noise when attempting to focus camera A. The camera would not focus throughout the mission.

Postflight testing showed no problem in focusing the camera. The thumping noise is an indicator of proper performance of the camera. The malfunction has been determined to be in the monochrome lens assembly rather than in the camera. CONCLUSION: The cause of the failure of the closed circuit television camera A to focus was determined to be in the monochrome lens assembly, not in the camera. This is not considered to be a generic problem. CORRECTIVE_ACTION: The FIAR written on the camera has been closed since the failure was determined to be in the monochrome lens assembly. A new FIAR has been opened on the monochrome lens assembly. The monchrome lens assembly will be returned to the vendor for failure analysis. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR B-FCE-029-F004	IFA STS-27-V-20C	CCTV
None	GMT:		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: Close Circuit Televison Remote Manipulator System Wrist Camera Failed to Turn On (GFE)

Summary: DISCUSSION: The remote manipulator system (RMS) wrist camera would not respond to a gamma command. Power was cycled and the camera worked properly for the remainder of the mission.

Postflight testing of the camera showed normal operation. The camera is designed to remain powered for 4 seconds after a turn off command is received, allowing time for the lens iris to close to prevent Silicon Intensified Target tube damage due to sunlight. Due to the lack of a power-on reset pulse to reset the command logic, the camera will not react to commands during this 4-second interval. CONCLUSION: The most probable cause of the failure of the RMS wrist camera to respond to a gamma command was that a switch was changed from wrist-to-elbow, then back to wrist within a 4-second interval. This is the expected response to this sequence of events, and will not occur when using existing operational procedures. CORRECTIVE_ACTION: The Crew Training Division has been notified to advise subsequent crews of the procedures to be used to prevent reoccurrance of this behavior. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-27-V-21	D&C - Panels
None	**GMT:**		**SPR** 27RF11	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Surface Position Indicator "Off" Flag Visible During Descent. (ORB)

Summary: DISCUSSION: The flight crew reported that during entry, the surface position indicator (SPI) "Off" flag was visible and the rudder position indicator appeared stationary at approximately four degrees left. The flag is driven by fault circuitry which detects a difference between commanded and actual indicator position.

Postflight troubleshooting at KSC failed to reproduce the anomaly. The unit will be removed and sent to the Rockwell Services Center for additional testing. Disassembly of the unit is not planned unless a hard failure can be isolated. CONCLUSION: The most probable cause of the anomaly is intermittent stiction of the rudder position indicator. The cause of the stiction is not known. CORRECTIVE_ACTION: None, pending hard failure. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:20	Problem	**FIAR** B-FCE-029-F008	**IFA** STS-27-V-22	OI - Recorders
INCO-01	**GMT:** 337:14:51		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Temporary Loss of OPS 2 Recorder Dump Telemetry (GFE)

Summary: DISCUSSION: At 337:14:50:20 G.m.t., a temporary loss of playback data was experienced during the OPS 2 recorder track 2 dump prior to the orbital maneuvering subsystem (OMS) 2 burn. At the 29 percent-of-tape point (on track 2), telemetry (TLM) indicated no tape motion and percent-tape was not updating. Dump modulation was verified on the ground, although the dumped data were noisy. This anomaly continued through the end-of-tape (EOT), and when the tracks switched from

2 to 1 and tape direction was reversed, the noise continued until the 29 percent-of-tape point was reached on track 1. This malfunction was not experienced again during the flight and had not previously be encountered. An attempt to dump the same data later in the mission was successful and the data were verified to be good.

OPS 2 telemetry data were examined postflight for the period between 337:14:25:32 and 337:15:19:31 G.m.t. The following paragraph describes the scenario that was established from the data and discussions with the ground personnel involved during the dump. After recording data on tracks 1 and 2 at 24 inches per second (in/sec), the OPS 2 recorder was commanded to dump at 120 in/sec starting at tape position 1, track 2. The status appeared normal until the telemetry point Tape Motion switched to low (indicating no motion) at approximately the Tape Position 9/10 boundary (29 percent of tape). Except for a one second Tape Motion indication (one sample period interval) at 337:14:52:34 G.m.t. (estimated to be approximately tape position 24), the Tape Motion and Tape Position telemetry remained inactive until 337:15:12:46 G.m.t. All other OPS 2 recorder telemetry were normal during the entire period including Track Number, Direction, EOT, and Mode. Tape Motion status returned at 337:15:12:46 G.m.t., and the Tape Position switched from 9 to 8 at 337:15:12:53 G.m.t. This time difference represents approximately one full Tape Position following the return of Tape Motion status. The time for the tape to run at the commanded speed is approximately correct to reach EOT and return to the point at which Tape Motion telemetry was regained. The most probable explanation for this anomaly is a shifting load on the recorder capstan causing drag on the motor. Motor drag would result in loss of phase lock between the servo and the motor. Since phase lock is required for the servo to update both Tape Motion and Tape Position, this condition would explain how the tape could actually be in motion without the telemetry updating. The tape running slower than normal (as a result of the drag) would also account for the noisy downlist. Normally, however, only one pass of tape to EOT is required to correct a capstan load shift. CONCLUSION: A shifting load on the capstan probably caused this anomaly. The load shift could have been caused by a tape pack shift on the reel, a negator spring dragging on its spool, or a mechanical anomaly in the Delta Drive assembly (capstans, drive belts, and motor). CORRECTIVE_ACTION: None. Given the inability to reproduce this problem in-flight or on the ground, plus the low criticality of this subsystem and the fact that vendor turnaround is excessive, fly the OPS 2 recorder as-is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:23:27	Problem	**FIAR**	**IFA** STS-27-V-23	OI - Recorders
None	**GMT:** 340:13:58		**SPR** 27RF15	**UA**	**Manager:**
			IPR	**PR** INS-4-04-0133	
					Engineer:

Title: Modular Auxiliary Data System Pulse Code Modulation Multiplexer Built-in Test Equipment Signal Annunciated on Power Up. (ORB)

Summary: DISCUSSION: When the modular auxiliary data system (MADS) was powered up at 340:13:58 G.m.t., a built-in test equipment (BITE) signal (V78X9611E) was annunciated. This signal is generated by BITE circuitry within the MADS Pulse Code Modulation (PCM) multiplexer unit. Power was cycled to the MADS PCM and the BITE indication was reset. It did not recur for the remainder of the mission.

This anomaly had occurred previously on OV-104 during checkout of the MADS PCM switch on November 3, 1988, but could not be reproduced in subsequent troubleshooting. The decision was made at the time to fly-as-is based on the criticality of the system. During postflight troubleshooting, the anomaly was reproduced by increasing Main B bus voltage to 31 Vdc. It was further isolated to be within the MADS PCM multiplexer unit. The unit was removed and replace with the unit designated for OV-102. CONCLUSION: The BITE indication was caused by an intermittent failure in the MADS PCM multiplexer unit. CORRECTIVE_ACTION: The failed unit will be returned to the vendor for failure analysis. Corrective action to be documented under CAR 27RF15. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-27-V-24	MPS
None	**GMT:** Prelaunch		**SPR** 27RF05	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Slow LH2 Fill/Drain Valve Closure (ORB)

Summary: DISCUSSION: The main propulsion system (MPS) liquid hydrogen (LH2) outboard fill/drain valve (PV11) closure times were greater than allowed by specification during prelaunch, MPS dump, and the first vacuum inerting. The valve functioned nominally for subsequent operations during the second vacuum inerting and postflight troubleshooting.

The outboard fill/drain valve closure response time is measured from the issuance of the close command to the closed microswitch indication. The specification requires a maximum closure time of 10 seconds which was exceeded during the following mission events: Lift-off - 48 seconds 10.876 seconds Propellant dump 13.276 seconds First vacuum inerting 12.776 seconds The slow closure during the terminal countdown sequencing came within 0.12 second of causing a Launch Commit Criteria (LCC) violation. This problem was not experienced on the two earlier flights of OV-104. The actuator used in this valve, however, had no previous flight experience. Data review shows that this particular actuator had the slowest closure response measured during acceptance testing at liquid nitrogen temperatures. This problem had no effect on the flight. CONCLUSION: The slowness of the LH2 outboard fill/drain valve during closure operations at cryogenic conditions was most probably caused by a sluggish actuator. The valve assembly appeared to operate normally at ambient conditions. CORRECTIVE_ACTION: The actuator was removed and replaced with an actuator that exhibited rapid closure times under cryogenic conditions during acceptance tests. The removed actuator is undergoing failure analysis at the vendor and will be tracked by CAR 27RF05. An LCC change is being submitted to allow an additional three seconds for valve closure before declaring a violation. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-27-V-25	MECH
None	**GMT:** Postlanding		**SPR** None	**UA**	**Manager:**

IPR **PR**

Engineer:

Title: Uncommanded Brake Pressure After Main Gear Touchdown (ORB)

Summary: DISCUSSION: Postflight data evaluation revealed that uncommanded brake pressures were present in hydraulic system 2 after main landing gear (MLG) touchdown. During the periods preceding and immediately following nose landing gear (NLG) touchdown, pressures of approximately 200 psia were attained.

After MLG touchdown, the elevons are commanded up to reduce the sink rate of the nose. After NLG touchdown, the elevons are commanded to the full down position to reduce loading on the main gear. Elevon movement produces a flow surge within the hydraulic system that results in a pressure increase. Since the elevons use hydraulic systems 2 and 3 as their primary supply, pressure surges occurred within both of these hydraulic systems. The braking system uses hydraulic systems 1 and 2 as the primary supplies and hydraulic system 3 as the standby supply for all brakes. Therefore, the brakes received the higher, uncommanded pressures through hydraulic system 2, which is in common with the elevons. STS-27 data reveals a crew-commanded movement of the elevons from a down position after MLG touchdown, and a software-commanded elevon movement to the 10 degree down position after NLG touchdown. The rise in hydraulic system 2 pressure and its accompanying uncommanded brake pressure coincide with this elevon movement. The pressure required to overcome the brake return springs and cause brake disc contact is between 180 and 200 psia. Although the actual occurrence of disc contact can not be determined for this instance, the 200-psia uncommanded brake pressure could cause the brake disc elements to be in light contact with no significant torque being generated. Post-touchdown uncommanded brake pressure due to elevon movement has been observed on several flights. The data review has failed to reveal any negative impact on the nose gear slapdown or subsequent rollout of these flights. CONCLUSION: Uncommanded brake pressure was experienced between MLG and NLG touchdown and after NLG touchdown as a result of planned elevon movement. The amount of pressure generated may have created a light contacting of the brake discs resulting in negligible braking torque. This condition has been observed on previous flights. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-27-V-26	MPS
None	**GMT:** Postlanding		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: MPS Helium Check Valve Stuck Open (ORB)

Summary: DISCUSSION: During postflight operations at KSC, the main propulsion system (MPS) engine 2 high-pressure helium-supply check valve (CV2) was found stuck in the full open position. The valve was disassembled during failure analysis and the poppet was found to be cocked and stuck in the end piece bore. Extensive wear (galling) was evident on both the poppet skirt and the end piece bore. The poppet was worn such that a sharp edge had formed on the end of the skirt and this caused the

poppet to become stuck in the bore.

The valve design permits the poppet to become cocked and form a sharp edge as the poppet rubs against the sleeve. A large spring-guide outside diameter and a short, tapered poppet skirt contribute to this phenomenon. The rubbing occurs normally during ground processing and mission-related usage. Additional rubbing occurs due to valve chattering, which is caused by the continuous helium flow rate experienced during replenish and checkout operations. The flow rate is at the planned level, however the valve is designed for a higher flow rate. Therefore, instead of firmly seating against the spring guide as designed, the poppet chatters as it reacts alternately to the spring force and the force of the helium flow. CV2 and its similar check valves (CV1, CV3, and CV4) found on the other two engine and pneumatic helium systems are used during the prelaunch helium fill and replenish operations. Should one of the engine check valves fail open, a subsequent failure of the helium fill disconnect (PD8) to close at T-13 seconds would cause excessive helium loss overboard and a possible ascent abort. There are 12 additional check valves of the same configuration in the MPS system. The failure of any one would cause loss of redundancy only. Similar check valves have been stuck open during ground tests on two previous occasions. Both failed valves were on OV-103 and occurred after several uses on flights and/or tests. This anomaly had no impact on the mission. CONCLUSION: The MPS engine 2 high-pressure helium supply check valve (CV2) was stuck in the open position because excessive wear allowed the valve to become cocked, thereby becoming stuck in the end piece bore. CORRECTIVE_ACTION: The CV1, CV2, CV3, and CV4 check valves will be replaced on all vehicles. The other helium check valves will undergo leak checks prior to the next flight of each vehicle. A periodic replacement plan for the check valves will be developed. A Launch Commit Criteria change is being considered that will verify that PD8 and CV1 through 4 are not simultaneously failed open. Because of the previous history of failures of this type of check valve, a redesign is being investigated. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE